THE GLASS INDUSTRY

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PITTSBURGH-CORNING PLANT BEGINS PRODUCTION

Incorporating up-to-date structures and the latest equipment for manufacturing glass block, the new plant of the Pittsburgh-Corning Corporation at Port Allegany, Pa., has gone into production. This plant, which was constructed in 1937, is a result of the formation of the Pittsburgh-Corning Corporation last year by Corning Glass Works and Pittsburgh Plate Glass for the development, manufacture and sale of certain types of glass block for the architectural and building fields.

Port Allegany, where the new plant is located, lies in the midst of the natural gas region of Northern Pennsylvania, about 90 miles from Corning and about 190 miles from Pittsburgh. Its location on the main line of the Pennsylvania Railroad between New York and Buffalo, and on U. S. Highway No. 6, makes it easily accessible. This town is also the home of the Pierce Glass Co., which has manufactured proprietary medicine bottles here for many years.

The site selected for the new plant is on the western outskirts of the town and adjacent to the railroad, which serves the plant by a siding that runs along the side of the main building. Fig. 1 is a general view of the side of the plant toward the railroad, from the west, and Fig. 2 shows the same side of the plant looking from the other end. The structures include the main building and stack, the raw material storage bins and mixing house, the compressor and switchboard house, and an elevated water tank. Offices are located on the second floor of the main building, which Fig. 1 shows at the left.

Practically all of the manufacturing functions are housed in the two-story main building, which is 400 ft. long and 80 ft. wide. The second floor is given over to the melting tank, forming machines, lehrs, inspection and packing, and offices. The ground floor provides space for the mould and machine shop, warehouse and shipping facilities, and has a ceiling height of 14 ft. The second floor in front of the tank is 8½ ft. below the tank glass level and a ramp at the left of the tank leads up to the charging floor, which is 6 ft. above the rest of the second floor.

The tank section of the building has a Robertson monitor-type ventilator on its roof. The side walls of this section are of steel sash and corrugated iron with 6-ft. panels on trunnions so that the whole tank end of the building can be opened for ventilation when desired. That section of the building which houses the lehrs has corrugated iron side walls with steel sash, the walls being insulated throughout with glass wool. The inspection and packing section has walls of brick and glass block. The roof above the annealing and inspection spaces has a big monitor for light and ventilation, so that all of the manufacturing space is exceptionally well lighted. Figs. 4, 5 and 6 illustrate the second floor arrangement and construction.

Fig. 1. New Pittsburgh-Corning plant from the west, showing construction of main building and installation of glass block in walls.

Fig. 2. This view of the plant from the south shows the bulk material silos, compressor house and main building. The picture was made before the batch house at the foot of the silos was completed. Batch storage tanks can be seen on the roof of the main building.

The one-story building which houses the air compressors and the switchboard is constructed of corrugated iron on a steel framework and is located a short distance from the tank end of the main building. There are four Ingersoll-Rand synchronous-motor-driven compressors, three of which have a low-pressure capacity of 50 cu. ft. and one high-pressure compressor has a capacity of 100 cu. ft. The switchboard has eleven panels and controls all of the reception and distribution of power for the plant. Niagara-Hudson power is purchased from the Bradford Electric Co. at 2,300 volts and is transformed to 440-volt current for all power circuits except to the synchronous motors on the air compressors. The transformers are located just outside the end of the building. A motor-generator set is provided for charging storage-battery trucks.

The raw material storage bins include a 24-ft. concrete silo for sand and two 20-ft. concrete silos for other bulk materials. The latter are divided into four sections by vertical partitions so that shipments can be segregated. The large silo has a storage capacity of 900 tons and the other two hold 400 tons each. Cullet is stored in a segmental silo between the two smaller round ones. A one-story building at the base of the silos provides storage for the small-quantity materials and houses the weighing and mixing equipment. The silos were monolithically poured by the Nicholson Company and are 60 ft. high.

The general design and construction of the plant was handled by the H. K. Ferguson Co., Cleveland, under the direction of Alfred Vaksdal, plant engineer of the Corning Glass Works, and ground was broken on July 8, 1937, so that the plant was ready for operation in something less than six months. Frazier-Simplex, Inc., had the contract for the tank, flues, valve and stack, the stack construction being sublet to Rust Engineering Co. The stack is of standard construction with a height of 135 ft. and a 4-ft. inside diameter. The water storage tank was built by the Pittsburgh-Des Moines Steel Co., has a capacity of 50,000 gallons, and is 100 ft. high. A drilled well furnishes 250 gallons of water per minute, the pump house being located at the foot of the standpipe. A city water connection is also provided.

Batch handling and charging

As shown in the plant layout, Fig. 3, the bins for the storage of bulk raw materials are located adjacent to the railroad siding. A track hopper receives the materials from the cars and a bucket elevator delivers them to a belt conveyor at the top of the silos. This conveyor is furnished with a traveling tripper so that the material may be discharged into any desired bin. The floor of the silos is 14 ft. above ground level and the automatic batch weighing equipment is located in this space. Thus the materials from the bins can be discharged by gravity directly into the automatic weigh hoppers. The hoppers, in turn, discharge the weighed batch constituents on a gathering belt which delivers to the mixer in the batch house at the opposite end of the silos from the railroad track.

Batch materials used in small quantities are delivered in packages and are stored in the batch house at the base of the silos, from which position they can be conveniently added to the batch in the mixer. All of the batch-handling elevators, conveyors and weighing equipment were furnished by the Chain-Belt Co., the weighing equipment incorporating Toledo scales and the entire installation being fitted with automatic control that reduces the required manual labor to a minimum.

The batch is mixed in a No. 28S Rex mixer and is then discharged into Easton batch buggies that are arranged for transportation on Yale & Towne storage-bat-

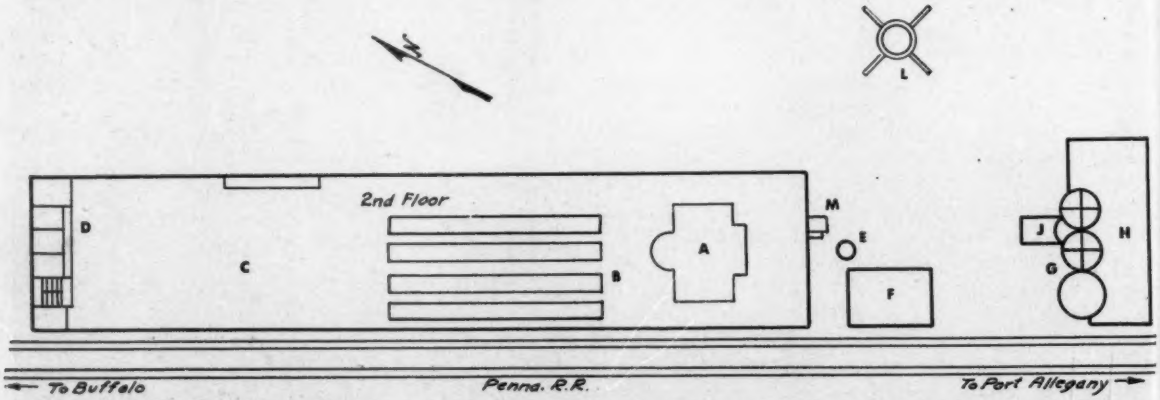

Fig. 3. Diagrammatic layout of plant. A—Tank; B—Lehrs; C—Inspection and packing department; D—Offices; E—Stack; F—Compressor and switchboard house; G—Bulk raw material silos; H—Batch house; J—Cullet house and bin; L—Water tank; M—Batch hopper and elevator.

tery trucks. The buggies are carried across the yard to a pit hopper where they are dumped and from which an elevator carries the batch to the storage bins on the roof of the main building above the tank. The elevator housing and the storage bins are shown in Figs. 2 and 7, these pictures having been made during the course of installation.

The tank has two doghouses, one at each side of the melting end, and each doghouse is serviced by a No. 332 H-A batch charger, built by the Simpson Foundry & Engineering Co.

Melting tank

The melting end of the tank is 18 ft. wide and has a length of 32 ft. from the back wall to the bridge, with a depth of 39 in. The bridge wall is 42 in. wide with a throat at the bottom center leading into the refining end, which has a depth of 27 in. The nose of the tank has a radius of 10 ft., the center of the arc being two feet in front of the bridge wall. The melting capacity of the tank is 80 tons per day.

Natural gas is used for firing the tank and is handled through eight ports, four on each side. The gas and air passages and the regenerators extend down to the ground floor level where they connect to the flues beneath the floor. These flues lead to the reversing valve which is connected through another short flue to the stack just outside the wall of the building. The body of the tank proper is supported on steel beams and columns. The natural gas for fuel is purchased from the North Penn Gas Co. and comes into the plant through a connection from the gas company's nearby mains.

A complete system for block cooling is installed and was designed by company engineers. The temperature indicating equipment is very complete and incorporates Leeds & Northrup instruments and panels.

Glass manufacturing equipment

The glass from which Pittsburgh-Corning blocks are manufactured is a crystal clear soda-lime-alumina composition which has been produced for many years by Corning Glass Works. The glass is fed to the forming machines by Hartford-Empire feeders, shown in the front view of the tank in Fig. 5. Forehearth temperatures are automatically controlled, natural gas being used for fuel as in all heating equipment throughout the plant. The forming machines are Type PBM Lynch presses. Special equipment of company design is used to assemble the block halves after the pressing operation.

At present the product is loaded into the lehrs by hand, but it is planned to utilize mechanical equipment as soon as all the production details are settled. The annealing equipment consists of four Hartford-Empire Type M lehrs, 110 ft. in length. The lehrs are fired by natural gas and lehr temperatures are indicated by 24 thermocouples located at various positions in the lehr tunnel. The lehr casings are constructed of sheet steel on a structural steel framework and are insulated with rock wool. Each lehr is a complete unit and is mounted on wheels, so that it can be located in the most convenient position for production purposes. The ware is transported through the lehr on a chain belt. Fig. 4 shows the lehrs while the assembly and insulation work was in progress.

Fig. 4. Second floor of the main building from the charging-floor ramp, showing lehr installation in progress.

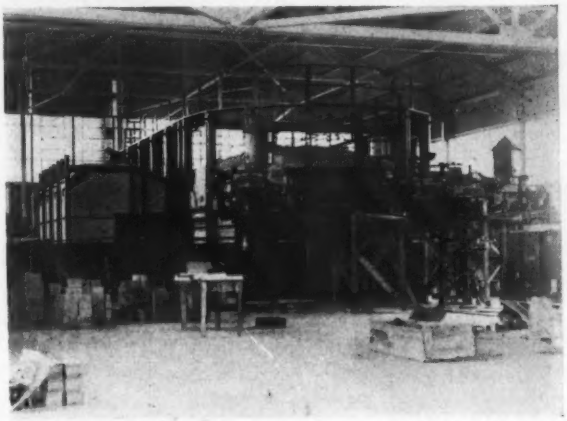

Fig. 5. The Pittsburgh-Corning tank with Hartford-Empire feeders in place shortly after construction work was finished.

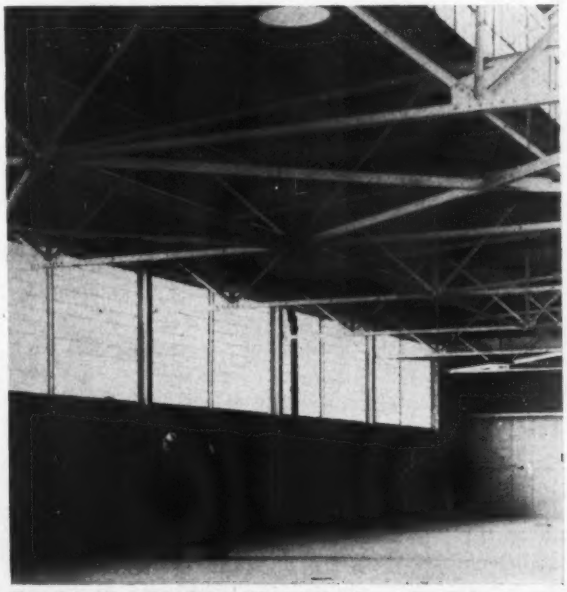

Fig. 6. Glass block installation in the wall of the inspection and finishing department.

Fig. 7. View of the new plant from the east showing the batch elevator and storage tanks under construction at the end of the main building.

Inspection, packing and shipping

The Pittsburgh-Corning glass blocks, illustrated in Fig. 8, are inspected and packed in cartons in that section of the second floor of the main building beyond the lehrs. The inspection and packing department space can be seen in the background of Fig. 4, and the glass-block outer wall of the department is shown in Fig. 6. The selected and packed ware is carried to the first-floor shipping room on a conveyor, and is loaded for shipment to the company warehouses in various distribution centers.

In the construction of this fine new plant it is apparent that much attention has been paid to proper working conditions for the employees. The ventilating arrangements and the fine natural lighting have already been mentioned and the artificial lighting arrangements are equally notable. Incandescent lamps with large reflectors are liberally spaced throughout all the buildings. All of the plant space heating is accomplished with Bryant unit heaters, each of which burns natural gas and incorporates a motor-driven fan to circulate the warm air. In the second-floor working spaces the heaters are attached to the bottom cords of the roof trusses and a total of 28 heaters is disposed throughout the plant. Good drinking water is furnished by sanitary drinking fountains located in convenient positions. Toilets and rest rooms are situated on the second floor of the main building and other toilets and showers are found on the first floor. A complete plant sprinkler system furnished by the Automatic Sprinkler Corp. of America affords ample protection against fire.

The operating personnel of the new plant has been recruited locally as far as possible and it has been necessary to import only a few skilled mechanics and operators. When full capacity is reached the plant will employ from 80 to 100 people. The local superintendent is L. O. Griffith, formerly with the Macbeth-Evans Division of Corning Glass Works at Charleroi. Mr. Griffith has been on the ground all during the construction of the new plant, supervising the construction work, and will continue as operating head. The general administrative offices are located in the Grant Building, Pittsburgh.

Two outstanding features characterize the new Pittsburgh-Corning plant: First, the efficiency of the plant layout for manufacturing purposes, since the production flow is uninterrupted from the receipt of the raw materials to the shipment of the finished product. Second, the manner in which the latest, most up-to-date equipment and practices have been combined to achieve a well-balanced, smooth-running plant unit. There is nothing radical about this new plant, but every detail shows careful attention and reflects the wide knowledge and long experience in glassmaking possessed by the sponsoring companies.

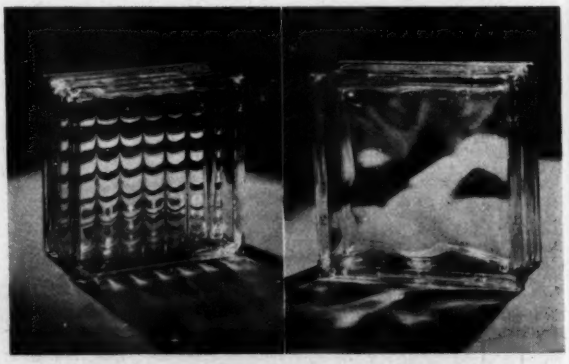

Fig. 8. Typical Pittsburgh-Corning glass blocks, "Argus" pattern at the left and "Decora" pattern at the right. Radius blocks for use at corners are also produced in both patterns.

AN IMMERSION CELL FOR POLARISCOPE USE

By EARL E. BEETON*

When one attempts to examine specimens of glass tubing or cane in an ordinary polariscope it is immediately evident that the results are far from satisfactory. Any piece of glass, such as tubing or rod, having a small radius of curvature, will act as a lens and refract the beam of polarized light so that it never reaches the eyepiece of the polariscope. The glass technologist interested in lamp or vacuum tube manufacture has many parts to inspect which offer the same difficulties of observation as glass tubing or cane. The glass bead surrounding a piece of tungsten wire, as shown later, is a typical example.

In studying the annealing of such a piece, one has to contend not only with the strain in the glass caused by faulty annealing but also the strain produced because of the unequal expansion of the glass and metal. It is often economically impossible to anneal such glass-to-metal seals to a strain-free condition, so it is important to know the exact value of the stresses. In glass-to-metal combinations it is not at all difficult to get stresses which are greater than the safe tensile limit of the glass. An immersion cell is the only means for the accurate determination of the stresses in such types of glassware and is a useful adjunct to a polariscope.

Immersion cells are usually made entirely of glass. Since the cell must have two opposite sides made of clear, strain-free glass, the usual type of rectangular glass jar is not suitable. Consequently glass immersion cells are usually made of ground and polished glass slabs cemented together. Such a cell is rather difficult to obtain and is fairly expensive. The cell to be described is simple and inexpensive and has been found adequate for small work.

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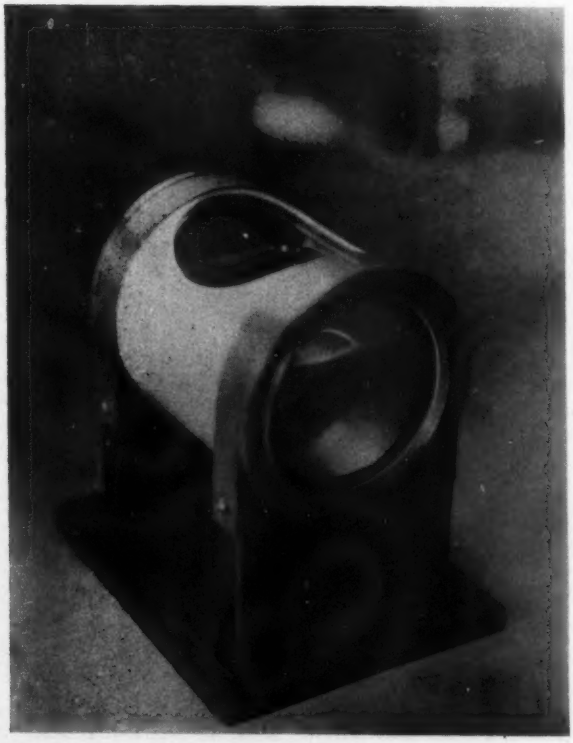


Fig. 1. Immersion cell.

Fig. 1 shows a photograph of the cell and Fig. 2 is a sketch of the general construction. Only a few dimensions are given, since the size and shape could be greatly varied without affecting the use of the cell. The body (A) is a piece of drawn seamless aluminum tubing 3 inches outside diameter and 3½ inches long. The ends (B) were machined from soft brass and were made so that when they were pressed into the aluminum tube the joints did not leak oil. This type of fit offers no difficulty to a good machinist, and the cell has never leaked at this point. The windows (C) were cut from a large sheet of double thickness window glass. The sheet was first inspected in a polariscope and certain areas which were free from strain were marked. From these areas a glazier cut the two windows. Two narrow gaskets (D) were cut for each end and the glass discs were put in place with a gasket on each side. The brass ring (E) was then screwed up against the gasket and the cell was assembled.

The choice of gasket material offered a little difficulty, as this cell uses ordinary mineral oil for the immersion medium. Heavy cardboard impregnated with paraffin was first tried but this leaked slowly. Cork gaskets were not satisfactory because they would usually tear in two when the brass rings were screwed up against them. The gaskets now in use were cut from ordinary Mason jar rubbers. These are entirely satisfactory. Because of their elasticity there is no danger of straining the glass mechanically when the brass rings are screwed up against them. When the cell was assembled it was checked in a polariscope to make sure that the windows were not strained in any way during assembly. For very precise work it would be advisable to use windows that were

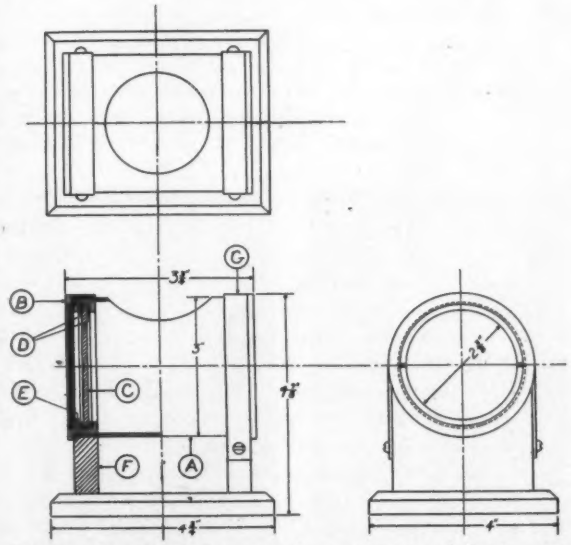
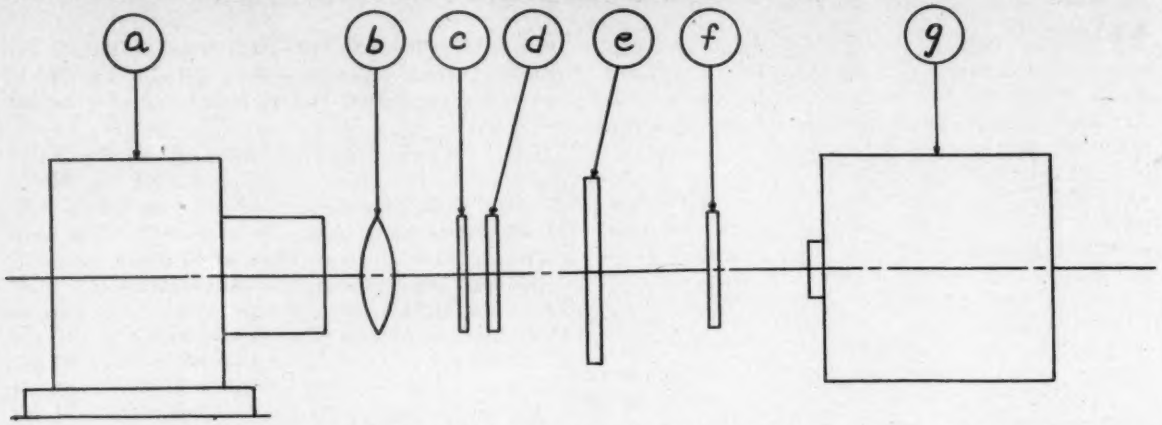


Fig. 2. Sketch of the general construction of the immersion cell.

Fig. 3. The set-up used for taking the pictures. A—Light source; B—Lens; C—Ground glass; D and F—Polarizing film (D is the polarizer and F the analyzer); E—The specimen and G—The camera. The ground glass was used only while setting up the apparatus and was removed before taking the pictures.



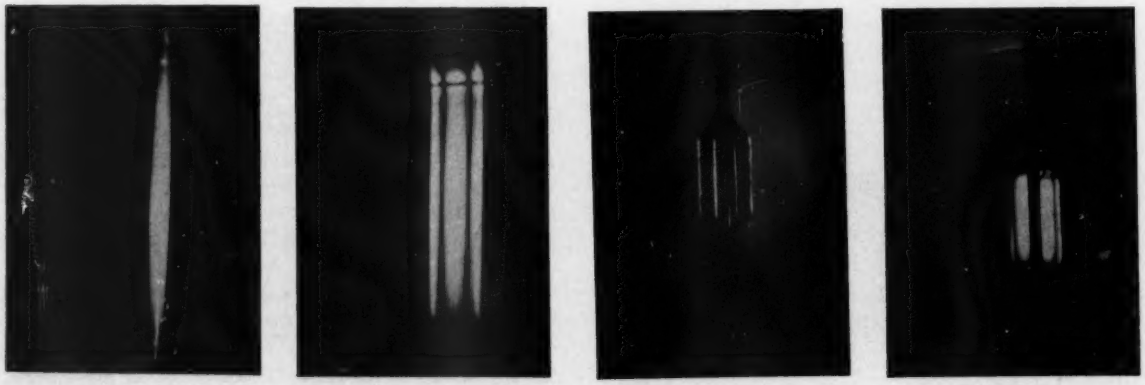
ground and polished and specially annealed to a strain-free condition comparable to optical glass. However, by carefully selecting the part of the sheet to be used, window glass will be found adequate for use in polariscopes in which the amount of stress is evaluated by means of the colors produced with a tint plate or by means of a quartz wedge. When using the quartz wedge it would be better to have the windows made from single thickness window glass.

A wooden cradle was made to hold the cell proper. The uprights (F) have a semicircular section cut out into which the aluminum tube rests. The cell is held in the cradle by two thin strips of brass (G).

The selection of the immersion medium depends on the type of glass used. The index of refraction for this medium should match that of the glass as nearly as possible, though it is not necessary that an exact match be obtained. For the glass used by the writer, which had an index of refraction somewhere near 1.48, Russian mineral oil was a satisfactory though not a perfect match. The index of refraction of lime bulb glass is about 1.51, while that of lead glass used for tubing and bulbs varies from about 1.54 to 1.56. Benzene should be suitable for the lime bulb glass, while, for the lead glasses, either xylol or nitrobenzene would probably be satisfactory. As a matter of convenience, suitable non-drying oils are much better than volatile organic solvents. Anyone wishing a closer match than would be given by the above liquids (or one who is working with glasses of different indices of refraction) can refer to a table of immersion liquids. If there is no liquid of the correct index listed, it is always possible to find two liquids that are perfectly miscible, one of which has a higher and the other a lower index of refraction than desired. A little experimenting will show the proper mixture of the two that is satisfactory. When the index of refraction of the liquid exactly matches that of the glass, the glass will be invisible when immersed in the liquid.

The photographs show to some extent the differences in the strain picture seen in a polariscope with and without the use of an immersion cell. These photographs fail to show the full extent of the differences between the two methods because they are in black and white. When a tint plate is used in the polariscope, the colors produced give the proper contrast between the two methods. These photographs were taken without the use of a tint plate.

Fig. 3 shows diagrammatically the set-up used for taking the pictures. The polarizer and analyzer were set up so that the plane of polarization of the light was at 45° to the vertical. Fig. 4 is a length of 0.6 cm. glass rod taken in air. Fig. 5 shows the same piece when the immersion cell was used. Fig. 6 is a photograph in air of a bead of glass fused around a piece of 60 mil tungsten wire. Fig. 7 shows this same bead immersed in the cell. It will be noticed that the ends of the bead in Fig. 6 look different from those in Fig. 7. This is probably because the bead acts as a short-focus lens. The



Left to right: Fig. 4, the cane in air. Fig. 5, the cane in oil. Fig. 6, the bead in air. Fig. 7, the bead in oil.

outline of the bead is seen in Fig. 7 as it actually looks. These pictures show that there is a great difference between the strain pattern seen in a polariscope when objects such as these are viewed with and without an immersion cell. Very nearly as much difference is noted when glass tubing is under inspection.

A. C. S. MEETING PLANS NEAR COMPLETION

Plans for the 40th Annual Meeting of the American Ceramic Society in New Orleans, during the week of March 27th, are rapidly approaching completion. It is realized that every person fortunate enough to attend this meeting will be keenly interested in the many places of historical and industrial importance to be found in and around this fascinating city and the local committee is, therefore, making extensive plans for guiding parties on sight-seeing tours. Several rooms on the second floor of Hotel Roosevelt have been set aside for educational exhibits and special and inexpensive provisions for students attending the meeting have been made.

In addition to the papers mentioned in the December issue of THE GLASS INDUSTRY, the following papers have been submitted and will be of special interest to glass men:

Recent developments in refractory patching materials for glass house usage, by H. D. Frankel, Jr., and John Klumpp.

Effect of glass color on the setting rates of glass in the manufacture of glass bottles, by O. G. Burch.

Glass block and its applications, by E. P. Lockart.

Fibre glass, by G. Slayter and J. H. Thomas.

Elastico - Viscous properties of certain potash - silica glasses, by N. W. Taylor and Robert Doran.

Report on Committee C-14 of A. S. T. M., by G. W. Morey.

Fluorescent glass, by W. Weyl.

A discussion of factors involved in stress release, by H. R. Lillie.

Permanent bend in glass canes, by H. R. Lillie.

Physical properties of B O glass, by H. R. Lillie.

Expansibility factors for boron oxide glasses, by S. R. Scholes.

Ring section examination of glass containers, by V. C. Swicker.

Special cars are being planned from such points as Chicago, Cleveland, New York and Washington, with stop-over privileges at Muscle Shoals, Norris Dam, or locations of prominent ceramic material deposits, as may be desired.

1938 A. C. S. OFFICERS NAMED

Word has been received from the American Ceramic Society that both nominating committees have placed in nomination the following officers for 1938: for President, Victor V. Kelsey; for Vice-President, Andrew I. Andrews; for Treasurer, C. Forrest Tefft.

PROF. TURNER'S ADDRESS IN BOOK FORM

The presidential address of Prof. W. E. S. Turner to the Society of Glass Technology on the occasion of its 21st Anniversary Meeting in Sheffield, England, has been printed and issued in book form. The book contains 70 pages of text, 47 tables and four figures, and incorporates much material never before available concerning world-wide developments in the glass industry. Copies of the book can be secured from the secretary at 10 shillings each, post free.

TONE IS AWARDED PERKINS MEDAL

The Perkins Medal of the Society of Chemical Industry was presented to Dr. Frank J. Tone, president of the Carborundum Co., at a joint meeting of the American Section of the Society of Chemical Industry and the American Chemical Society on Jan. 7. The medal is awarded annually for the most valuable work in applied chemistry and was given Dr. Tone for his work in the field of abrasives and refractories. James G. Vail of the Philadelphia Quartz Co., chairman of the American Section, presided over the meeting. The program included a talk on the life and accomplishments of the medalist by Dr. Carl G. Schluederberg and presentation of the medal by Professor Marston T. Bogert. Dr. Tone's medal address was entitled "The Quest for Hard Materials."

OPTICAL AND PHYSICAL SOCIETIES TO MEET

A joint meeting of the Optical Society of America and the American Physical Society will be held at Columbia University, Feb. 25-26, according to a recent announcement by L. A. Tuckerman, Secretary of the Optical Society. On Friday evening, Feb. 25, Dr. Harlow Shapley, director of the Harvard College Observatory, will deliver a lecture, initiating the Adolph Lomb Memorial Lectureship.

CHANGES IN FOURCO ORGANIZATION

Eugene Rolland, president, Fourco Glass Co., has announced the following changes in his organization: W. M. B. Sine resumes his former position with the company in charge of sales; J. Scott Walker is manager of Mid-Western sales and has headquarters in Chicago; Wayne E. Harding will be manager of Southern and Southwestern sales with headquarters in Fort Smith, Ark.; James A. Doyle will manage Eastern sales from New York City.

INSIDE FROSTING CASE WON BY G-E

After some months of litigation, word has been received that on Jan. 3, Judge Manton of the U. S. Circuit Court of Appeals, 2nd Circuit, reversed the decision of a lower court and decided in favor of the General Electric Co. in their suit against the Wabash Appliance Co. This suit concerned an infringement for the inside frosting of incandescent electric light bulbs.

This invention of Pipkin (U. S. Patent 1,687,510) is for a bulb with a novel inside frosted covering. It is the first inside frosted bulb produced having requisite strength for commercial use. The purpose is to diffuse the light from the incandescent filament or reduce the glare of the bulb, but the bulb must be strong enough to withstand the shocks and impacts incident to manufacture, transportation and use.

Judge Manton, in finding that the Wabash Appliance Co. was guilty of infringement, pointed out that a former employee of G-E, who had been with them for over 12 years engaged in the manufacture of this type of bulb, was now following the same practice with Wabash.

EXPERIENCE IN OPERATING REVOLVING-GRATE GAS PRODUCERS

By OSCAR HEIBER*

• *In this article a practical factory engineer gives the results of various operating conditions on the quality of producer gas as shown by repeated Orsat analyses.*
—The Editor.

When the gas producer is freshly put in operation and—to judge by the yellow gas with its characteristic odor—is ready to be cut into the main line, a gas analysis showed that there was 14.3 per cent CO_2, only 8.6 per cent CO, and 3.8 per cent H_2, with methane up to 3.0 per cent, for a total fuel value of only 72 B.t.u./ft.^{3}. Unquestionably this producer ought not yet to be connected to the main. Although the stoker's rule: "Der Gas muss gelb sein, und schmecken wie Honigseim" (The gas must be yellow, and smell like honey mellow) seems to indicate differently, analysis shows the real state of affairs.

But, after two hours and a half of operation, the CO_2 content has dropped to 4.9 per cent, CO is up to nearly 26 per cent, and the H_2 is at 9.7 per cent; and the fuel value has risen to 150 B.t.u./ft.^{3}. A further improvement takes place after another two hours, and after three days of operation (and three hours after a break-down), the gas has a fuel value of 180 B.t.u./ft.^{3}.

Some interesting observations are made on the relationshop between conditions in the fuel bed as revealed by poker tests, and the condition of the gas. The following depths were measured:

Ash zone	50	inches
Fire bed	32	"
Raw coal (distillation zone)	6	"

At this time gas analyses showed between 5 and 6 per cent CO_2, .4 per cent Olefines, about 30 per cent CO, and nearly 18 per cent H_2, with consistently 3.4 per cent CH_4, and a calorific value of 190. But since at this particular plant they were accustomed to getting 30-32 per cent CO, less than 4.5 per cent CO_2, and 15-16 per cent H_2, these analyses were not satisfactory. In another producer, where the incandescent zone, or fire bed, had a depth of 14 inches with only 4 inches of raw coal or dark zone, the analysis did show the desired CO, but lower H_2; so that the fuel value of the gas was below 180. The relationship between depth of fire bed and CO-content was borne out by other measurements and analyses.

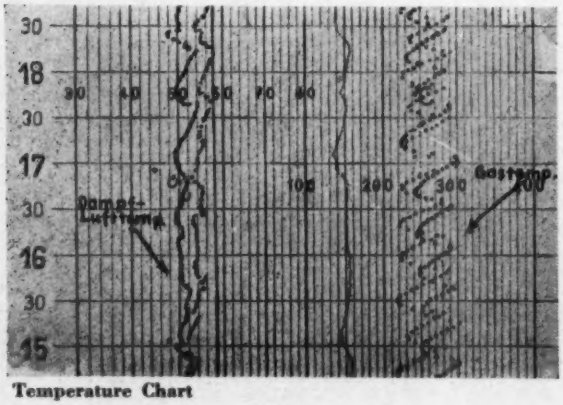
Evidently the producers under discussion were periodically charged or fed with coal. Some space is devoted to the effect of this charging upon the gas composition, and it is shown that the best gas is being made about 9 minutes after charging, where 15 minutes is the complete charging period. At this time the nitrogen content is lowest, and the fuel value of the gas accordingly reaches its high point of nearly 190 B.t.u./ft.^{3}. The suggestion is made, that where several producers are operating on the same line, these charging periods should be staggered in such a way as to give a gas of medium quality to the furnaces at all times.

Controls are, of course, described and recommended, particularly a recording thermometer showing the temperature of the air-steam mixture blown into the producer. This is maintained between 120 and 140° F. The tendency of the workmen to use an excess of steam, because it makes the poking and ash removal easier, is restrained by this definite record, which shows them at all times the best mixture for use. Similarly, a record of the temperature of the gas leaving the producer helps to complete the picture of conditions inside.

Another control strongly recommended is that of the pressure of the producer gas, because of the very beneficial effect that constant pressure has on furnace operation.

[We might comment on this account of producer operation by saying that the results both in composition and calorific value of the gas are remarkable. In comparison with American practice, it is evident that the fuel bed is very deep. If we can take the figures on the temperature chart at their face value the gas temperature seems not to rise above 600° F. It seems likely that this temperature has been taken in the main, at some distance from the producer, or else the relatively deep layer of raw coal has accomplished a great deal in lowering the temperature of the raw gas. The question naturally arises whether it would not be better to make a more dilute gas, with a higher nitrogen content and lower calorific value, but with much higher sensible heat, which will provide for its more effective transportation through the main without tar deposition, and for a higher temperature for the gas entering the furnace.]

*Translated from Glashutte for Dec. 18, 1937.



Temperature Chart

SLICK GLASS CO. PLANS IMMEDIATE ACTIVITY

Upon completion of purchase negotiations in December, the Slick Glass Co. has taken over the plant formerly operated by the U. S. Glass Co. in Gas City, Ind., and plans for putting the plant into production have been announced by Edwin E. Slick, Jr., president of the new company. Fire has been started in one of the five furnaces at the plant, which has been idle since 1932. E. E. Slick, Sr., Pittsburgh, is vice-president and Mable Henschen, is secretary.

FIRST GLASS TRAIN STARTS TOUR OF BRITAIN

By Geoffrey Blackall

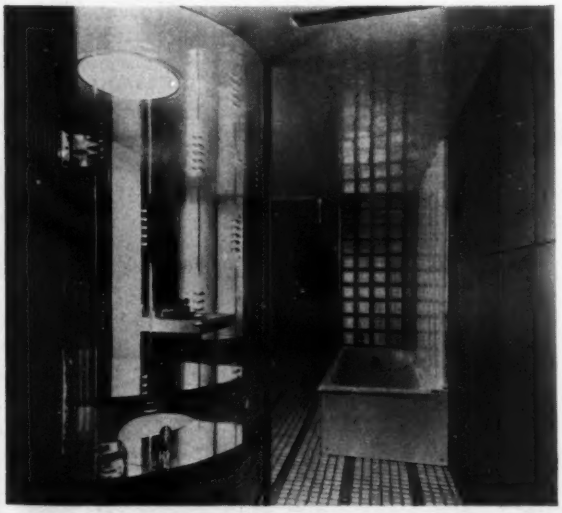
The first glass railroad train ever constructed has just started from Liverpool on a five months' tour of the leading cities of England, Scotland and Wales and will complete its itinerary at Birmingham the end of March. The purpose of the "Glass Age Exposition Train" is to give architects, the building trades and the public some idea of the remarkable variety of glass products at their disposal today and at the same time to show how useful and beautiful glass can be. This comprehensive exposition of glass for construction and decoration was designed by Kenneth Cheesman, prominent glass architect, the glass being manufactured at Kirk Sandall Works, Doncaster.

Outstanding uses for glass exhibited in the train are: to keep out the sun's rays, to keep out cold (glass brick), to admit ultra-violet rays (vita glass), to resist heat and severe impact (armor plate glass), to line walls (Vitrolite), to fit round curved surfaces (Vitroflex), to diffuse light (prismatic glass). Almost all of the 200 varieties of glass now produced commercially in the United Kingdom are included in the train.

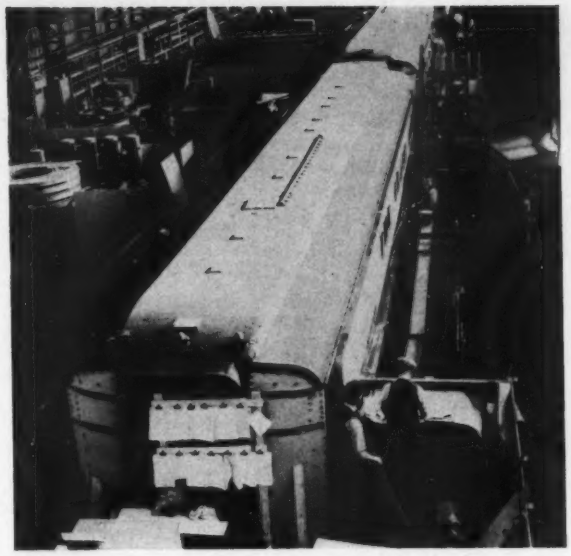
The outside of the coachwork, with the exception of the roof, is almost entirely covered with glass (see the Front Cover). Strips of flexible mirrored glass run the entire length of the train, leaving a space only for the glass letters: "The Glass Age Exhibition Train." No fewer than 120,000 miniature mirrors are used in the Vitroflex which covers the outside of the train.

Throughout the train the walls, floors and ceilings are of glass. There is little else but glass visible. Even in the locomotive cab, glass is used as a mounting for the switches.

Features of interest in the train are a light fitting of glass ribbon strips, an illuminated table with rough-cut plate glass supports and Vitrolite top, the floor of pressed Vitrolite tiles and a curved screen of clear pink polished plate.



The model bathroom described in the text. At the extreme left is shown what is known as feathered washboard glass because it is used in Lancashire in small lengths for washing clothes.



Two hundred varieties of glass are displayed in this train, shown here under construction at Messrs. Pilkington Bros., Doncaster, England.

In the bathroom, pink polished plate is silvered and used as a wall lining in a variety of surface textures in conjunction with ivory Vitrolite. Illuminated pilasters of fluted glass and a wall treatment of bent Vitrolite and glass rods are also included in the decorative plan. A screen of glass masonry separates the bathroom from a vestibule. The latter has a floor of dull gray silvered glass tiles used with an inlay of tango Vitrolite. A fire ensemble effectively demonstrates that glass need not necessarily look cold. It consists of a decorative surround, built up of thick silvered plates with heraldic motives deeply sandblasted, and indirectly illuminated by tango Vitroflex reflectors.

Between the bathroom and the cocktail bar, there is a semi-transparent plate glass dividing screen with an illuminated ceiling consisting of alternate panels of clear and silvered prismatic glass. The bar counter provides an example of the decorative application of glass brick. The counter top is of thick rough-cast plate, partly silvered with illuminated motifs. The walls are of cadmium Vitrolite and the floor of ivory tiles with an inlay of cadmium Vitrolite.

In the rotunda, a mirror wall and ceiling succeeds in converting a small semi-circular room into a large circular hall appearing double the height. A decorative lighting feature is built up of radiating fins of armor-plate glass. The walls are of steel blue polished plate, brilliant-cut, stippled and silvered, while the floor is of clear glass tiles, silvered.

The next section of the train is an exhibition room in which large samples of glasses suitable for safety roofing, partitions, dome-lights, etc., are displayed on screens, together with photographs showing the manner and scale of application to actual buildings. The same glasses are silvered and applied as wall linings.

A second display room has eight sliding panels featuring Vitrolite plans suitable for bathrooms, kitchens, vestibules, cocktail bars, etc. A fixing demonstration (behind sliding panels) has also been provided to illustrate glass construction methods. Armor-light moulded

glass, including high and low tension insulators are displayed in show cases, while glasses for illumination are incorporated in wall lighting panels.

The next section is occupied by a sample bureau, in which a comprehensive range of glass products is shown, together with examples of the decorative processes which can be applied to them. Glass floor tiles, both clear and silvered, are displayed in pull-out trays.

The final section of the train is devoted to a demonstration of the properties of armor-plate glass. This is shown twisting through an angle of 15 degrees without breaking. It is also shown supporting a weight of 224 lbs. and also heated to a temperature of 250°C with cold water dripping on it. A variety of articles in which this glass plays an essential part comprises the rest of the exhibits in this section. These include oven doors, machinery guards, road signs, hospital tables, floodlights and ships' portholes.

Even the exit is used to feature the remarkable uses to which glass can be put. Here rough-cast plate glass is silvered and used as a wall lining. A double glazed screen is employed to give an uninterrupted view of the motor room, and at the same time to reduce the noise from the Diesel generating plant to a minimum.

WILLIAM J. WOODS DIES

William J. Woods of the Corning Glass Works died recently at Corning, N. Y., after a continuous period of service with the company since 1898. He was first a bulb blower and later became foreman of hand bulb production. In 1916 he transferred to the Wellsboro plant, of which he was the first superintendent, and four years later returned to the main plant at Corning where he was made superintendent. In 1924 he joined the Mechanical Development Department of the company to devote full time to the invention and development of glass-making machinery. Mr. Woods' aptitude for mechanical methods did much to promote the mechanization of the glass industry, particularly in the field of incandescent bulb production. He was closely identified with the development of automatic bulb-blowing equipment, including the "E" and "F" machines and the present ribbon-type machine. Among his recent inventions was the Woods up-draw tubing machine and the full-automatic method of making thermometer tubing.

H. S. HEICHERT IS DEAD

Herman S. Heichert, chief engineer of the Pittsburgh Plate Glass Co., died in Orlando, Fla., Dec. 31, 1937, after a prolonged illness. In 1901, he became affiliated with the Pittsburgh Platte Glass Co., and after a period of over two years as Assistant Superintendent of the Ford City plant he returned to Pittsburgh on January 1, 1911, and became Assistant Chief Engineer of the company. Continuing in this capacity until the fall of 1922, Mr. Heichert was appointed Chief Engineer and held this position until his death.

• The Lapel, Ind., plant of the Sterling Glass Division of the Warfield Glass Co., Chicago, has been closed since the middle of December for the annual period of repairs which includes the installation of an entirely new melting unit. The shutdown period will be about three months in duration, and a majority of the employees are working on the repair and reconditioning program.

ANCHOR-HOCKING OFFICIALS ELECTED

Directors of the Anchor-Hocking Glass Corporation, recently formed through the merger of the Anchor Cap & Closure Corporation and the Hocking Glass Co., have announced the election of the principal executive officers. I. R. Stewart, former head of Anchor, was elected chairman of the board of the new corporation. I. J. Collins, Hocking's former president, becomes president of Anchor-Hocking, and William V. Fisher, vice-president and general manager. Also elected to vice-presidencies were Thomas C. Fulton, H. J. Carr, Dudley King, B. E. Factor, and G. F. Rieman.

G. C. Siems becomes secretary and assistant treasurer. Other executives elected include H. T. Hamlin, comptroller, assistant secretary and assistant treasurer; J. S. B. Smith, assistant secretary, and T. C. Schlub, assistant secretary and assistant treasurer.

CORNING CONSTRUCTS NEW UNIT

Construction of the new production unit of the Corning Glass Works on Steuben Street, Corning, N. Y., had progressed to the point that work on the first tank was commenced during the last week in December. The building will have 100,000 sq. ft. of space on each of two floors and was begun in August, with the H. K. Ferguson Co., Cleveland, in charge of operations. Walls and roof of the new structure are finished and interior construction is under way. The new unit extends about 700 feet along Steuben St., north of the Fall Brook Division plant at Steuben St. and Tioga Ave. The new factory will be used for the manufacture of pressed ware and other lines in the development stage, and represents the largest increase in production capacity at Corning in many years.

INCANDESCENT LAMP SALES SET NEW RECORD IN 1937

A preliminary estimate indicates that more than 955,000,000 incandescent lamps were sold in the United States during 1937, according to a review of the electrical industry by Guy Bartlett of the General Electric Co. In the cases of both 515,000,000 large and 440,000,000 miniature lamps new records were set. Perfection of a new high-efficiency tungsten filament, which increases the light output of incandescent lamps 10 per cent without using additional current, was one of the outstanding developments in the field of lighting during 1937.

LIBBEY-OWENS-FORD PROTECTS TRADE-MARK RIGHTS

In a recent circular letter to the trade, G. P. MacNichol, Jr., vice-president in charge of sales, Libbey-Owens-Ford Glass Co., announced the intention of the company to protect itself, together with its legitimate distributors and dealers, against further unfair competition and infringements of its trade-mark rights. In December the company was successful in securing a final decree from the U. S. District Court for the District of Columbia, perpetually enjoining and restraining the G & G Auto Parts Corporation from applying the L-O-F trade-mark to glass made by other manufacturers and from selling and delivering other makes of glass in response to calls for L-O-F glass. Other cases of this nature are already being investigated and, as soon as sufficiently definite proof is secured, the company intends to bring similar suits for injunctions and damages.

HOW FORD MAKES ITS GLASS: III

By F. G. SCHWALBE
Toledo Engineering Co.

This, the third of a series of three articles on the production of glass at the Ford Motor Co. plant, deals with the inspection, cutting, edge-grinding and laminating processes. The first article described batch handling, mixing and melting, while the second was concerned with rolling, grinding and polishing.

After leaving the Ford grinding and polishing lines, as described in the second article of this series, the glass is conveyed to the washing department where the glass sheets are placed on a belt conveyor. The width of this belt is slightly greater than that of the sheet and it carries the sheet into the washing machine. A similar belt at the opposite end of the washing machine acts to pull the sheet through the washer. Plaster, rouge and all other surface dirt is removed by a spray of acid solution, after which the glass is rinsed and passes through a set of squeegee rolls and then leaves the washer. As shown in Fig. 1, the washing machine is completely enclosed to retain the acid solution, the top of the washer being provided with windows so that its operation may be observed.

As it leaves the washing machine, the glass sheet is inspected for reams, scratches and such other surface defects as may have passed the initial inspection at the discharge end of the annealing lehr. This inspection is made as the sheet is moving on a series of widely spaced rollers. Located below the glass are a row of lights which provide ample illumination to permit easy detection of sheet defects. As they are noted, the defects are marked, so that the cutters can readily divide the large sheets into the desired sizes of blanks for Ford automobile glass.

Continuous cutting to bracket sizes

After leaving the inspection conveyor the glass sheets are carried by a continuously moving flat rubber belt into the cutting department. Cutting the large sheets into the most desired bracket sizes is rapidly accomplished by means of the Ford continuous bracket cutting and measuring device. This device, as illustrated in Fig. 2, incorporates a triangular frame, the upper and lower parts of which are provided with flanged rollers to hold the device in line and to permit its movement along the glass-carrying conveyor. Mounted on the frame is a dial indicator which revolves as the frame is moved along the conveyor and indicates the distance traveled relative to the continuously moving glass. The dial pointer can be instantly reset by pressing a convenient button. The pointer is driven through a sprocket and shaft by a chain located above the conveyor belt and moving at the same speed as the belt, so that when the device is held stationary the lineal travel of the glass relative to the frame is indicated on the dial.

To make a cut across the sheet, the frame is clamped so that it will travel with the sheet and a vertical score is made with the cutter held in the right hand, after which the measuring dial is reset to zero and the left hand unclamps the device from the traveling sheet. The operator now shifts the frame at will until the dial indicates the length he desires to cut, when the device is again clamped to travel with the sheet and the second vertical score can then be made. Horizontal cuts are made by means of a cutter that forms part of the measuring device, this cutter being slidably mounted on a vertical scale. By grasping the handle which lowers the cutter to the sheet and then moving the entire device, a horizontal cut of any desired length can be made.

Following the cutting operation, a second operator breaks the glass, removes it from the cutting conveyor, and places it on one of the many racks carried by a continuously moving overhead conveyor.

Cutting to shape

The glass, now in bracket sizes, must next be cut to shape. The common method of doing this is to place a

Fig. 1. Glass entering washing machine after grinding and polishing. Vacuum-type hoist in upper right corner.

Fig. 2. Continuously moving glass being cut to bracket sizes with the Ford special cutting and measuring device.

Photos courtesy of the Ford Motor Company.

Fig. 3. Swiveling-template type of machine for cutting glass to shape.

Fig. 4. Glass with a uniform coating of cement leaves the drying end of the cementing chamber.

template on the glass and manually guide a glass cutter around the outline of the template, but such a cutting procedure involves a great number of unproductive motions.

The simplest of the many cutting machines designed by Ford engineers is shown in Fig. 3. The template in this machine swivels, thus eliminating the backing-up motion of the operator around the template, necessary when cutting in the old-fashioned manner. In this machine a movable cutter is mounted in a cam race secured to the swivelling template and a handle is provided at the top of the cutting instrument to lower the cutter into contact with the glass. Pressure of the cutter on the glass is always kept constant by means of an electro-magnetic device on which the cutter is mounted. The under side of the aluminum plate to which the cutting cam template is attached has a series of vacuum cups which holds the glass in position during the cutting operation. This device will cut around the entire periphery of the sheet.

To operate the cutting machine shown in Fig. 3, a sheet of glass is placed below the swivel template and vacuum is applied to hold the sheet in position. The operator lowers the cutter into contact with the glass and, by moving the cutting device, causes the template to swivel through a full revolution. A hand cutter is now used to score the corners, so that the waste edges can be removed, and the sheet is removed from the machine by releasing the vacuum from the holding cups. The cut sheet is then placed in one of the overhead conveying racks which carries it to the laminating department.

A second type of machine is used when it is desired to cut only three sides of the sheet. The operation of this machine is similar to the one just described, except that the template does not swivel. The cutting device is similar in action to that used on the swivel type of machine.

A third type of cutting machine operates in a similar manner, but is more completely mechanized and uses a stationary template around which the cutting device mechanically travels. The glass is carried on a three-position table which automatically indexes through 120 degrees. At the first position one operator places an uncut sheet in the machine. The table then indexes 120 degrees, carrying the sheet into position under the cutting template, where the cutting device is immediately lowered into contact with the glass and automatically travels around the template. Limit switches start and stop the cutting device and, upon the completion of the cutting operation, the table indexes another 120 degrees carrying the glass to the third position. At this point a second operator scores the corner of the

Fig. 5. Assembling the glass sandwich. From right to left the operations include placing the acetate sheet on the glass, covering with a second sheet of glass and passing the sandwich to the roller press.

Fig. 6. Autoclaves with controls, showing the method of handling the trays of glass sandwiches.

sheet with a hand cutter, breaks off the waste edges, and places the finished sheet in one of the overhead conveyor racks. The glass removed from the edges of the sheet falls into a chute adjacent to the machine and the cullet is discharged upon a conveyor which carries it to the batch plant.

Laminating Ford safety glass

The use of laminated glass as standard equipment for windshields was introduced by Ford in 1927 and to Ford goes the credit for first placing the process of laminating glass on a large-scale manufacturing basis.

After leaving the cutting department the glass is conveyed to the laminating division where it enters an automatic washing machine through which it is carried on power-driven rollers. Here it is sprayed with water, scrubbed by revolving brushes, and squeegee rolls finally remove the excess water. The glass is again inspected and, if clean, enters the cementing chamber shown in Fig. 4, where a uniform coating of cement is applied to one face of the glass by means of rolls. Next all of the low-boiling solvent or liquid in the cement mixture is vaporized in a drying oven, from which the glass emerges and is carried along on an open length of conveyor. At this point operators place a plastic sheet of cellulose acetate on the cemented face of the glass. The acetate sheet has a thickness of approximately 0.025 inches and adheres to the cement-coated glass.

A second operator now places a second sheet of glass upon the acetate, thus making a sandwich that is composed of two sheets of glass and a sheet of acetate. The assembling of this sandwich is shown in Fig. 5. As the sandwich proceeds down the conveyor, it passes through a roller press where it is firmly tacked together and can be handled thereafter without separating. The sandwiches are now loaded into stainless-steel trays, each tray holding from five to six hundred pieces, depending on the size of the sandwiches. Several of the loaded trays are locked together and are then ready to be placed in the autoclave.

The autoclave, shown in Fig. 6, is an upright, cylindrical, steel vessel capable of withstanding high pressure and the top is provided with a heavy tight-sealing lid. The loaded trays are picked up by an overhead crane, placed in the autoclave, and the lid is closed and clamped in place. The process of subjecting the sandwiches to temperature and hydrostatic pressure then begins, a solution of diethylene glycol and carbitol being used at an initial temperature of 175°F. The pressure in the autoclave is now raised to 225 lbs. per sq. in. and the temperature to 300°F., the sandwich being held at this temperature and pressure for a period of three minutes, after which the solution is cooled to 175° F. The pressure is then released and, upon emergence from the autoclave, the final bonding action is complete and the sandwich has been rendered clear and transparent.

Edge grinding

The laminated glass now has approximately the size and shape desired, but the edges of the glass are sharp and somewhat irregular. Grinding of the edges to remove the irregularities is done on the continuous machine shown in Fig. 7. Practically all of the glass used by Ford requires grinding only on the top and side edges and this machine grinds three edges only.

For the operation of this machine a pile of laminated plates is clamped in a fixture on a small table at the side of the machine and the fixture is then lifted and transported to the machine on a tramrail trolley. The fixture is lowered onto a slowly revolving spindle of the grinding machine where the edges of the sheets make contact with a grinding wheel that has a diameter of about eight inches and a height slightly greater than the height of the pack of sheets in the fixture. The grinding wheel is mounted on an arm so that it can swivel in a horizontal plane and adjust itself to the required contour of the finished sheets. The wheel is driven by an electric motor at about 800 r.p.m. and is held in contact with the edges of the sheets by means of counterweights attached to the swivel arm.

The path of the grinding wheel is controlled by a cam mounted on the revolving fixture spindle, so that all

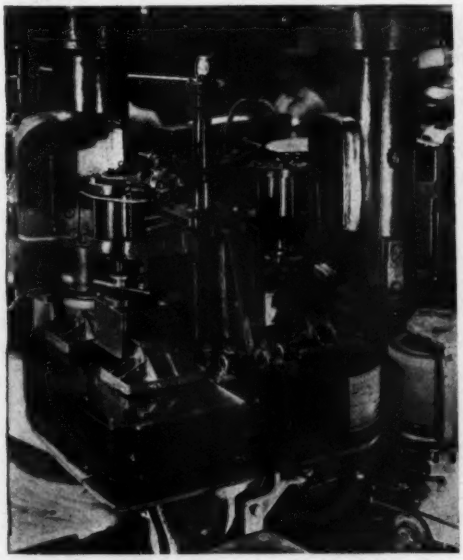


Fig. 7. Right: Continuous edge-grinding machine, showing packs of laminated glass, grinding wheels and cam rollers.
Fig. 8. Left: Hand method of edge grinding.

sheets of a given pattern are identical in size and shape when they leave the machine. The spindle makes approximately one revolution in five minutes and, when the spindle has made three quarters of a revolution, the sheets have been ground on three edges and are ready for removal from the machine. Removal of the finished sheets and placing a new pack of unground sheets is accomplished without stopping the machine.

It is interesting to contrast the operation of the machine with the slower and more laborious method of edge grinding by hand. In this method, shown in Fig. 8, the sheet is guided along the face of a grinding wheel and, of course, no two finished sheets will be exactly alike. This method does, however, remove all sharp edges and the sheet is finished when it leaves the operator's hands. This is not true of the sheets from the automatic edge-grinder, because these sheets have square edges with sharp square corners. The removal of these sharp corners is done in a few moments by an operator who holds the sharp edge against a continuously moving emery-cloth belt and, with slight pressure, efficiently and neatly rounds the corners.

However, the edges of the finished sandwich must be sealed against the entrance of moisture which would cause discoloration. The next step is, therefore, to remove sufficient plastic material at the edges of the sandwich so that the crack can be filled with water-proofing material. The under-cutting process is carried to a depth of $\frac{1}{8}$ in. by the action of an acid solution, into which the trays containing the sandwiches from the autoclave are lowered. The solution consists of concentrated sulphuric acid with two per cent nitrating nitric and the sandwiches remain in this solution from 10 to 15 minutes, depending on the concentration of the solution. When the concentration drops to 70 per cent the solution is replaced. Fig. 9 shows the acid tank. After undercutting the glass is thoroughly washed and dried.

Sealing

The next and final operation consists in sealing the edges of the sheet against moisture. The laminated sheet is fed into one end of a sealing machine in which it is automatically conveyed along, indexed so that each edge is filled in succession, washed, dried and presented for inspection as it emerges at the other end. Fig. 10 shows a hand sealing machine. Here the operator guides the edge of the sheet along the face of a slowly revolving wheel which forces the soft, putty-like sealing material into the undercut space left when the acetate was removed by the acid solution.

Fig. 9. Acid tanks in which the plastic layer of the laminated glass is undercut for sealing.

Fig. 10. Hand sealing machines.

After a final cleaning operation the Ford insignia is clearly sandblasted into one corner of the glass. This insignia reads, "Ford Safety Glass" and also gives the month and year of manufacture. The Ford safety-glass sheet is now a completely finished product and ready to be installed in a Ford automobile.

E. C. P. D. ACCREDITS SIX CERAMIC SCHOOLS

In the field of ceramic engineering, six schools were found to have met the requirements of the Engineers' Council for Professional Development. They are as follows: University of Illinois (Technical Option), Missouri School of Mines and Metallurgy, New York State College of Ceramics at Alfred University, North Carolina State College, Ohio State University, University of Washington.

In the inspection of ceramic engineering curricula the Committee on Engineering Schools cooperated very closely with the Committee on Ceramic Education of the American Ceramic Society. The E. C. P. D. committee felt that it should draw on the experience of individuals fully acquainted with ceramic engineering education requirements, and advisors, selected from a list furnished by the A. C. S., were invited to join the committees of inspection when curricula in ceramic engineering were being considered.

The E. C. P. D., which has carried out the accrediting process during the past two years, is a joint organization created by seven national engineering societies for the purpose of enhancing the status of the engineering profession. The participating groups are: American Society of Civil Engineers, The American Society of Mechanical Engineers, American Institute of Electrical Engineers, American Institute of Mining and Metallurgical Engineers, American Institute of Chemical Engineers, The Society for the Promotion of Engineering Education, and National Council of State Boards of Engineering Examiners.

THE CHEMICAL DURABILITY OF GLASS, AND METHODS FOR ITS ESTIMATION

Dr. W. Tepohl, in *Glashutte* for Aug. 21, 1937, presents an excellent brief essay on the durability of glass.

The widespread application of glass seems to indicate that it is absolutely resistant to chemical attack, and the apparently permanent luster of our window-panes leads us to the impression that it is completely water resistant. But observation of many old window-panes or pieces of glass apparatus finds unmistakable evidence of surface alteration. This evidence is not local spots or scratches, but an irregular dimming of the surface, resembling a very fine layer of scum. There are many remarks in print about this alteration of glass surfaces, and the decay of many a cathedral window is unquestionably a result of weathering.

When glass is used not only in contact with water but in other solutions, the attack proceeds more rapidly in alkaline solutions, whereas the glass may be quite resistant to acids. Most commercial glasses are not attacked more rapidly by acids than by pure water. There are glasses, however, that are more attacked by acids or, indeed, are rapidly decomposed. Of course hydrofluoric acid naturally occupies a special place in this consideration. The great difference in the behavior of various glasses indicates that, as a rule, glasses of high alkali content are more susceptible to chemical attack.

The most general attack upon glass is called weathering. This presents a difficult problem, because the process goes very slowly, and is complicated, and does not lend itself readily to a testing method. The principal agent in weathering is water, which gives rise to hydrolysis, setting free alkali, which then takes part in the weathering process. It is thus of particular importance whether the alkali thus liberated remains in contact with the glass, as in closely packed, stored ware; or whether it is frequently washed off, as from windows. Furthermore, the carbon dioxide of the air takes part in the chemical processes, and sometimes sulfur gases, as in railway coaches exposed to smoke from the locomotives. As in all chemical processes, temperature plays an important part.

In estimating the tendency of a glass to weather, we have two fundamentally different methods; first, the measurement of the cloudiness of the glass surface; and the measurement of the decomposed mass of glass, especially that of the alkali liberated. Since surface effects are visible only after months or even years, the first method of testing is scarcely of utility. But so is the quantitative estimation of the liberated alkali somewhat difficult, since this is very small in amount. As this is accelerated by raising the temperature to 80-100° C. results are no longer strictly comparable with the weathering process.

Mylius made use of the dye iodeosin, which is yellow as a free acid, to test the weathering of surfaces. When an ether solution of this dye is placed upon the glass surface, it is colored cherry red by liberated alkali, and this red alkali salt is then water soluble. This stain serves to magnify the effect of water on the glass surface, and to render the results easily visible and comparable. By comparing the resulting solution with one of known alkali content, Mylius could get comparative values of alkali liberated by weathering. This weathering test is of value only for glasses not subjected to strong chemicals during their use; for example, window, mirror and optical glass.

Those glasses which during their normal use are subjected to water for long periods or at elevated temperatures are, of course, more strongly attacked. Another sort of testing method is required. A number of methods have been proposed which need not all be described but which have, nevertheless, essentially the same principle. The specimen is maintained for a definite time, usually from one to five hours, in contact with distilled water in the neighborhood of the boiling point, and the alkali liberated from the glass is estimated by titration of the solution. Mylius also developed a method of this sort in which he exposed the glass to water at 80° for three hours, titrated the alkali, and calculated the number of milligrams of Na_2O liberated per 100 cm^2 of exposed glass surface. Glasses were arbitrarily separated into five classes, the first of which showed not more than 15 milligrams of dissolved alkali, up to the fifth class, in which over 600 milligrams were found.

For the most part, this hydrolytic testing is done on pulverized glass, classified between two standard sieves to a rather definite grain size. Such is the D.G.G. Standard Testing Method, in which ten grains of powder, based upon the normal specific gravity of 2.5, with a grain size between 0.30 and 0.49 mm. is digested for five hours with boiling distilled water. Results are obtained by evaporating the extraction water and weighing the residue. This process also permits classification as to weathering tendencies.

It may seem strange that water alone has been used as the testing solution, and that the attack of alkali and acid solution has been much less frequently investigated. This fact may be explained by saying that most glasses are not measurably more rapidly attacked by acid than by water, whereas all glasses are decomposed by alkaline liquids, perhaps one hundred times as fast as by water. Nevertheless, numbers of experiments, some of them dating back as much as four decades, have been directed to testing glasses with acids and alkalies. One of these rather interesting tests is of the tendency of polished surfaces to be spotted by weak acids, carried out by allowing one drop of dilute acetic acid to remain on the polished surface for 24 hours. After washing and drying, the local effect on the polish could be observed, and even be more or less quantitatively measured.

All chemical methods for the testing of glass, whose results are expressed numerically, tend to show what weight of substance has been removed from the surface — whether it is alkali, heavy metal oxide, or the entire glass substance. There are other methods which do not give numerical results, but depend upon the subjective judgment of the experimenter; as, for example, the spot methods just described, and another which is the testing of medicine bottles according to the directions in German medical practice, using an alkaloid salt, and observing the amount of cloudiness or precipitation produced. In determining the resistance of glasses to sterilizing

steam, some quantitative estimation of loss of weight is utilized as well as the visible effect on the glass surface.

Whereas testing results can be made to agree on the same variety of glass within ±5 per cent, there are certain great errors which are difficult to explain. It is possible, however, to predict the behavior of glass toward chemical attack rather safely if one does not rely upon a single test value; that is, too much attention should not be paid to a few agreeing results, but rather more to the preponderance of results around an average. It is not justifiable to state that certain glasses are better or worse, because they differ only a few percent in these tests. It is better to regard them in such cases as practically of equal value. When we consider the wide limits between which the susceptibility of glasses to chemical attack may range, our methods of testing seem to appear more satisfactory.

MAGNESIA IN RAW MATERIALS

In *Glashutte* for Oct. 16, 1937, Dr. Zschacke comments on the magnesia content of American glasses as compared with the European compositions for similar purposes. He remarks that automatic production has gone ahead faster in this country than in Europe, and suggests that the increased workability of the American compositions due to their magnesia content may be, in large measure, responsible.

A number of batches are set forth in which substitution of dolomite for part of the high-calcium lime or limestone is the conspicuous feature.

While the use of dolomite lime in America may be laid in part to the fact that we have rather more excellent and abundant supplies of dolomite than of calcite, it is gratifying to find confirmation of the advantages of this practice, in the view of an eminent German authority.

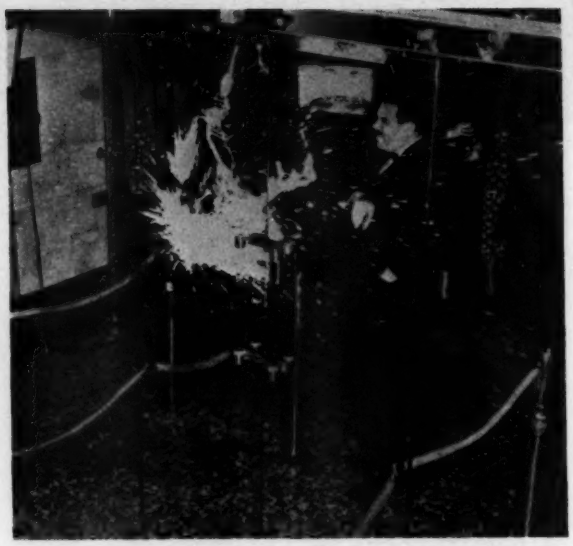
SPODUMENE DEPOSITS IN NORTH CAROLINA

As a result of the discovery of a tremendous amount of spodumene in North Carolina in 1936 by Frank Hess, U. S. Bureau of Mines geologist, the needs of this country for spodume can be filled for a century or more. Spodumene, in addition to being the lightest metal known, is used as an alloy to harden such metals as aluminum and lead and in the manufacture of lithium chloride salt, now being used extensively in certain types of air-conditioning.

Aside from its value as the source of lithium, spodumene is used in its pure state in the manufacture of glass and chinaware. The color is usually white, looking very much like feldspar, but occurs in other shades, usually grayish-green or greenish-white with a pearly lustre and a vitreous cross fracture. Much of the spodumene found in North Carolina deposits is almost 100 per cent pure, although some is mixed with other minerals and decayed rock.

A furnace has been built on the property to separate the spodumene from other minerals found in the rock formations by the calcining method. When lumps of the mineral are heated to a high temperature, the matter in the ore remains in large lumps above the screen. It is thus possible to obtain almost 100 per cent pure spodumene at the site of the mine before any is shipped. No attempt has been made so far to process the spodumene and derive lithium from it in North Carolina, although several concerns are known to be interested in acquiring some of these spodumene deposits and in erecting complete processing plants.

At present, the development of this deposit is being carried on in a very limited manner. Geologists and industrial engineers predict that the presence of this mineral in such large quantities should bring about the development of another large mineral industry in the state. North Carolina is already recognized as one of the largest producers of kaolin and feldspar in the world.



Grover Whalen, president of the New York World's Fair, is shown christening the country's first tempered all-glass doors, which have just been installed in the lobby of 40 Wall St., New York. Judging from Mr. Whalen's expression, he hasn't much confidence in the ability of any glass to survive the impact of a heavy champagne bottle. The doors were built for Robert W. Dowling of the Starrett Corporation by the Pittsburgh Plate Glass Co. The glass is capable of supporting five times the weight which can be sustained by ordinary plate glass and is much more flexible. Four of the eight doors open and close automatically by means of "electric eyes."

BAKELITE ANNOUNCES NEW PLASTIC

A new polystyrene molding material, recently announced by the Bakelite Corporation, New York, possesses several properties not formerly incorporated in molded plastics. The new material has a tensile strength of 5,000 to 5,500 lbs. per sq. in., with a specific gravity of 1.07 in the molded form, so it is comparatively stronger and lighter than most types of such materials. It is different, too, in the fact that it retains an ability to be softened and distorted at higher temperatures, although the manufacturer states that molded parts will withstand temperatures up to 176°F without distortion, when the load involved is simply their own weight. The new material is said to have better qualities as an electrical insulator and for water resistance than former materials. It resists concentrated sulphuric acid and concentrated alkalies, but is soluble in a variety of materials, including benzine, toluene, turpentine, carbon tetrachloride, etc. Produced primarily for electrical insulating and chemical resisting applications, the new polystyrene plastic is naturally almost water-white in molded form. It is said to transmit 87 per cent of incident light and its hardness is from 120 to 125 Rockwell.

GLASS NEWS FROM JAPAN

Asahi Glass profits down—In its second 1937 business term, the Asahi Glass Co., Japan's 40,000,000 yen concern, realized a net profit of 4,497,000 yen and declared a dividend of 15 per cent. Compared with the preceding term, the net profit was down 6,124,000 yen. The sales turn over, however, continued active, reaching 27,254,000 yen during the half-year term.

The company has decided to diversify its business and export its products "in a positive manner." As a first step, Asahi completed a special glass factory at Tsurumi, and a second plant, adjoining the former, will be ready for operation in March or April.

The waterfront of Tsurumi near Yokohama has seen the rise during the past three years of Japan's promising automotive industry, and Japan's glassmakers have cast an eye on this expanding market. Asahi Glass in its new Tsurumi factory will specialize in automotive glasses, including safety glass and aircraft glass.

With an annual productive capacity of 4,420,000 cases, Asahi Glass has become a figure in by-products as well. Output in the principal lines is as follows: Soda ash, 350,000 long tons; Caustic soda, 100,000 long tons; Sodium bicarbonate, 23,000 long tons; Sesquicarbonate soda, 10,000 long tons; Calcium chloride, 20,000 long tons; Bricks, 24,000 long tons; Pure sodium carbonate, 600 long tons.

Prices of glass products advanced by Osaka makers—Because of the aggravation of the profit situation, the glass industry guild of Osaka has decided to advance the prices of principal products by 10 to 20 per cent, effective Jan. 1. The rate of increase for the major items is as follows: table ware and lamps, 10 per cent; bottles and containers, 15 per cent; laboratory glass ware and glass tubes, 20 per cent.

Glass spun yarn subjected to compulsory conditioning—The Aichi prefectural government has decided to subject the glass spun yarn trade to a system of compulsory conditioning. The decision was made after consultation with the manufacturers in the Nagoya district of the prefecture, which is the center of the Japanese glass spinning industry. It is understood that the authorities have resorted to this step since the possibility is seen that glass yarn, if technically improved, may be utilized as substitute for cotton yarn on a large scale.

Japanese glass men have an eye on North China—With overproduction establishing itself as a regular feature in Japan's glass trade, producers of plate and sheet glass are anxious to find an outlet in North China, the *Nikkan Kogyo* reports. Among the firms who have dispatched investigators in the wake of the Japanese Army are the Showa Glass and the Sennen Engineering Company. The plans of these firms are being watched by the Asahi Glass interests, which are operating the Yaohua Glass Works at Chingwangtao and the Shoko Glass Works at Dairen.

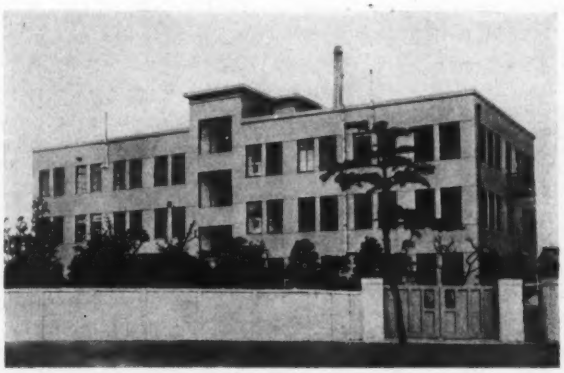
Special glass producers expanding business—While producers of ordinary plate glass are looking forward to the cessation of the current hostilities, which are responsible for an unprecedented market depression, makers of special glass in Japan are now in the heyday of their prosperity. Two small private enterprises, the Iwaki and Suzuki glass works, have recently been reorganized on a joint-stock basis. The Nippon Quartz Glass, which started operation only last September, has already doubled its net capacity. The Nippon Glass Kogyo-Sho, a small semi-industrial special glass laboratory, has attracted the attention of Jun Noguchi, head of Japan's 200-million yen Nichitsu chemical trust and obtained 100,000 yen as an encouragement fund.

Iwaki is a subsidiary of the Nippon Electric Engineering Co., a predominantly American-backed concern. The recent reorganization of the firm involved a capital increase to 1.2 million yen. Suzuki specializes in glass accessories for rayon and other spinning machinery. The firm is now capitalized at 100,000 yen.

New beer into old bottles—500,000 metric tons of waste glass is utilized by Japanese beer-bottle makers every year in the production of new bottles in whose composition it constitutes 30 per cent on an average. Moreover, 175 million beer bottles are returned intact to their original bottlers annually, cleaned, relabeled, refilled and resold. Only 75 million bottles out of the 250 million required annually by the beer industry come fresh from the bottle-making machine.

New type crown seal—An Australian inventor has applied for Japanese patent rights on a new type of crown seal for beer and cider bottles and is collecting quotations from Japanese makers on lots of 1 million pieces. Although the construction of the new bottle closure is similar to the conventional crown seal, no opener is required to remove it from the bottle. Removal is effected by an attachment to the crown-shaped rim. The whole may be produced in a single stamping operation and the cost of production is the same as for ordinary closures, as the sheet metal waste normally occurring in the punching is utilized to produce the opening attachment.

Drastic drop in Japan's plate glass consumption—Reflecting the decline of Japan's building activity in recent months the domestic demand for plate and window glass has dropped 40 per cent below normal. Efforts are being made to dispose of the mounting stocks on overseas markets at cut-throat prices.



The new Asahi glass laboratory.

CURRENT PRICES OF GLASS-MAKING MATERIALS

FURNISHED BY PRODUCERS, MANUFACTURERS AND DEALERS

Base Materials

		Carlots	Less Carlots
Barium carbonate ($BaCO_3$), Crude, (Witherite) 90%, 99% through 200 mesh	ton	43.00	46.00
Barium sulphate, in bags	ton	19.00	24.00
Barium sulphate, glassmaker's, carlots, bulk f. o. b. shipping point	ton	15.00-16.00	18.00
Borax ($Na_2B_4O_7 10H_2O$)	lb.	....	....
Granulated	In bags, lb.	.021	.0255-.028
Powdered	In bags, lb.	.0235	.028-.0305
Boric acid (H_3BO_3) granulated	In bags, lb.	.0475	.0525-.055
Calcium phosphate ($Ca_3(PO_4)_2$)	lb.	.07	.07½
Cryolite ($Na_3Al\ F_6$) Natural Greenland (Kryolith)	lb.	.0875	.0925
Synthetic (Artificial)	lb.	.0875	.0925
Feldspar—			
20 mesh	ton	11.00-13.25	
40 mesh	ton	11.50-13.75	
Granular	ton	11.75-14.00	
Semi-granular	ton	11.00-13.25	
L. C. L., (Min. 2 tons) $3.00 per ton additional plus charge for bags			
Fluorspar (CaF_2) domestic, ground, 96-98% (max SiO_2, 2½%)			
Bulk, carloads, f. o. b. mines	ton	31.50	....
In bags	ton	33.10	38.00-40.60
Kryolith (see Cryolite)			
Lead Oxide (Pb_3O_4) (red lead) (N. Y.)	lb.	.074	....
In 5 Ton lots	lb.	....	.0775
Less than 5 Tons	lb.	....	.0825
Lime—			
Hydrated ($Ca(OH)_2$) (in paper sacks)	ton	10.50	....
Burnt (CaO) ground, in bulk	ton	7.00	....
Burnt, ground, in paper sacks	ton	9.00	....
Burnt, ground, in 280 lb. bbls.	Per bbl.	2.25	2.25
Potassium carbonate—			
Calcined (K_2CO_3) 96-98%	lb.	.065	.0675
Hydrated 80-85%	lb.	.055	.0575
Salt cake, glassmakers (Na_2SO_4)	ton	18.00	27.00
Soda ash (Na_2CO_3) dense, 58%—			
Bulk	Flat Per 100 lb.	.95	....
In barrels	Per 100 lb.	1.35	....
In bags	Per 100 lb.	1.10	....
Sodium nitrate ($NaNO_3$)—			
Refined (gran.) in bbls.	Per 100 lb.	....	2.50-2.90
95% and 97%			
Bulk	Per 100 lb.	1.35	....
200 lb. bags		1.415	1.44
100 lb. bags		1.45	1.475

Special Materials

		Carlots	Less Carlots
Aluminum hydrate ($Al(OH)_3$)	lb.	....	.03½
Aluminum oxide (Al_2O_3)	lb.	.04	.05
Antimony oxide (Sb_2O_3)	lb.	.15	.15½
Arsenic trioxide (As_2O_3) (dense white) 99%	lb.	.03	.03½
Barium nitrate ($Ba(NO_3)_2$)	lb.	....	.07¾
Rutile (TiO_2) powdered, 95%	lb.	.11-.12	.13-.15
Sodium fluosilicate (Na_2SiF_6)	lb.	.05¾	.06
Tin Oxide (SnO_2) in bbls.	lb.	....	.48
Zinc Oxide (ZnO)			
American process, Bags	lb.	.06¼	.06½
White Seal, 150 lb. bbls.	lb.	.08⅜	.09
Green Seal bags	lb.	.08	.08¼
Domestic White Seal bags	lb.	.08½	.08¾
Red Seal, bags	lb.	.07½	.07¾
Zircon			
Refined Granular (Milled .005-.02c higher)		.07	0.7½-.08
Commercial, Gran. (Milled .005-.02c higher)		.03	.04-.05

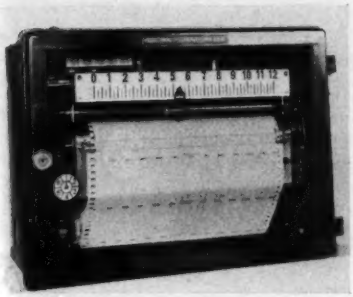
Coloring Materials

		Carlots	Less Carlots
Barium selenite ($BaSeO_3$)	lb.	....	1.50-1.75
(Commercial, 25% Selenium)	lb.	....	.90
Cadmium sulphide (CdS)	lb.	....	1.25-1.35
Chromite (99% through 200 mesh)	lb.	37.00	40.00
Cerium hydrate			
100 lb. drums and 600 lb. barrels	lb.	....	.60
Chrome Oxide Green, 400 lb. bbls.	lb.	....	.22-.26
Cobalt oxide (Co_2O_3)			
In bbls	lb.	....	1.67
In 10 lb. tins	lb.	....	1.77
Copper oxide			
Red (Cu_2O)	lb.	....	.20¼
Black (CuO)	lb.	....	.15½-.18½
Black prepared	lb.	....	.22
Iron Oxide—			
Red (Fe_2O_3)	lb.	....	.0425
Black (Fe_3O_4)	lb.	.04½	....
Iron Chromate	lb.	....	.035-.05
Lead Chromate ($PbCrO_4$)	lb.	....	.16
Manganese, Black Oxide			
In Paper bags	ton	57.00	64.50-66.50
In Burlap bags	ton	65.50	67.50-69.50
In Casks	ton	70.50	72.50-74.50
Neodymium oxalate, 50 lb. drums	lb.	....	3.50
Nickel oxide (Ni_2O_3), black	lb.	....	.35-.40
Nickel monoxide (NiO), green	lb.	....	.35-.40
Potassium bichromate ($K_2Cr_2O_7$)—			
Crystals	lb	.08⅜	.0925
Powdered	lb.	....	.0975
Potassium Chromate (K_2CrO_4) 100 lb. kegs	lb.	....	.27
Powder blue	lb.	....	.2075
Pyrophyllite, Standard Grade	lb.	9.00	12.00
Rare earth hydrate			
100 lb. drums	lb.	....	.35
325 lb. barrels	lb.	....	.30
Selenium (Se) In 100 lb. lots	lb.	....	2.00
In lesser quantities	lb.	....	2.10
Sodium bichromate ($Na_2Cr_2O_7$)	lb.	.06⅞	.0725
Sodium chromate (Na_2CrO_4) Anhydrous	lb.	.08¼	.08⅝
Sodium selenite (Na_2SeO_3)	lb.	....	1.80-2.00
Sodium uranate (Na_2UO_4) Orange	lb.	....	1.50-1.55
Yellow	lb.	....	1.50-1.55
Sodium uranyl carbonate	lb.	....	.80-.90
Sulphur (S)—			
Flowers, in bbls.	Per 100 lb.	3.35	3.70-4.10
Flowers, in bags	Per 100 lb.	3.00	3.35-3.75
Flour, heavy, in 250 lb. bbls.	Per 100 lb.	2.90	3.25-3.65
Uranium oxide (UO_2) (black, 96% U_3O_8) 100 lb. lots. Black	lb.	....	2.25
Yellow orange	lb.	....	1.50

Polishing Materials

		Carlots	Less Carlots
Emery, Turkish	lb.	....	.07
Pumice Stone,			
American Ground Italian FFF, FF, F	lb.	....	.03
0, 0½, ½, 1.	lb.	....	.03¼
Putty Powder	lb.	....	.38-.42
Rotten Stone	lb.	....	.03
Rouge, Red	lb.	....	.14
Black	lb.	....	.16

EQUIPMENT AND SUPPLIES



NEW FEATURES IN BROWN RECORDING PYROMETER

Brown Instrument Co., Philadelphia, is now furnishing a multi-color, numeral-printing potentiometer pyrometer which not only records several temperatures on one chart, but also provides a more legible record in both multi-color and numerals. When the temperature changes overlap no special skill is required to decipher every detail of the chart record.

Only one symbol, the plus sign, is used and a numeral printed beside the symbol identifies the thermocouple from which the temperature record is made. The vertical line of the plus sign indicates the temperature and the horizontal line shows the time coordinate. The intersection of the two lines locates the exact point of the time-temperature record. By means of a 12-inch chart and this method of printing it is possible to record from two to six temperatures continuously.

Other standard features of the instrument include a 40-inch slide wire, enclosed galvanometer, sturdy drive mechanism and synchronous motor drive. Folder No. 84-9, entitled "Legibility and Precision", explains the device and reproduces the numerical records in color.

DU BOIS APPOINTED

The Consolidated Feldspar Corporation, Trenton, N. J., has appointed H. B. Du Bois to represent them in the Trenton and Eastern territory with headquarters at the main office, 1403 Trenton Trust Building, Trenton. Mr. Du Bois was formerly in charge of the Ohio territory.

ARTICLE ON ZIRCONIUM

The leading article in the current number of *Foote-Prints* deals with zirconium, discussing the oxide, the metal, and some of its alloys. This paper, by J. D. Fast, is translated from the Dutch.

Although the rarity and high cost of zirconia (ZrO_2) make it quite unfamiliar, it is of interest to glass men because of its high melting point—about 2700°C.—and its limited solubility in glass. A number of phase diagrams are shown, giving the behavior of zirconia with magnesia, with lime, and with other bases.

The metal is of more interest and importance to those engaged in the manufacture of radio tubes and valves. Not the least important feature of the paper is the list of 86 references to articles on zirconium and its compounds. The publishers, The Foote Mineral Co., specialize in ores and metals of unusual character; and they supply zirconium and zirconia in a number of forms.

NEW CHLORINE PLANT

H. K. Ferguson Co., Cleveland, has designed and is now constructing a complete chlorine plant for the Southern Alkali Corporation at Corpus Christi, Tex. Southern Alkali is a subsidiary of the Pittsburgh Plate Glass Co.

CATALOGS RECEIVED

C. J. Tagliabue Mfg. Co., Brooklyn, N. Y. A new 28-page catalog, No. 1101D, describes and illustrates features of Tag Celectray indicating, recording and controlling pyrometers and resistance thermometers. These instruments utilize a phototube, mirror galvanometer and a beam of light. Accuracy of 0.1 per cent with high sensitivity is claimed.

The Cambridge Wire Cloth Company, Cambridge, Md. An excellently illustrated 8-page bulletin provides complete information about Monel Metal Woven-Wire Conveyor Belts, listing the distinctive qualifications of monel metal, illustrating typical installations and describing various belt constructions.

The Foxboro Co., Foxboro, Mass. Bulletin 198-1 covers recording thermometers of the vapor-pressure, gas-pressure and liquid-expansion types. All details of construction and operation are included in this 40-page book.

Fish-Schurman Corp., New York. Literature distributed by the U. S. agents for Jena Glass Works, Schott & Gen. includes Catalog JL270, describing Jena Fritted Glass Filters and Apparatus, and Bulletin 4892E, describing Jena Solid Optical Filter Glasses.

The Brown Instrument Co., Philadelphia, Pa. Catalog No. 5001 supplies much pertinent data on Brown Automatic Boiler Regulation for boilers under 1,000 h.p., operating at pressures up to 300 lbs. Items covered include steam damper regulator, over-fire control, control valves, accessories, and installation arrangements. The 24-page book is profusely illustrated.

Consolidated Ashcroft Hancock Divisions, Manning, Maxwell & Moore, Inc., Bridgeport, Conn. Bulletin 2300 illustrates and describes the American Wide-Range indicating controller, in which a thermostatic vapor system operates the controller and a dial thermometer. For temperatures up to 490° and pressures up to 500 lbs.

Belt Conveyors and Bucket Elevators. Catalog No. 47. Stephens-Adamson Mfg. Co., Aurora, Ill. This is not only an extremely informative catalog, but the data is presented in an extremely handy and readable fashion. The information is thoroughly indexed.

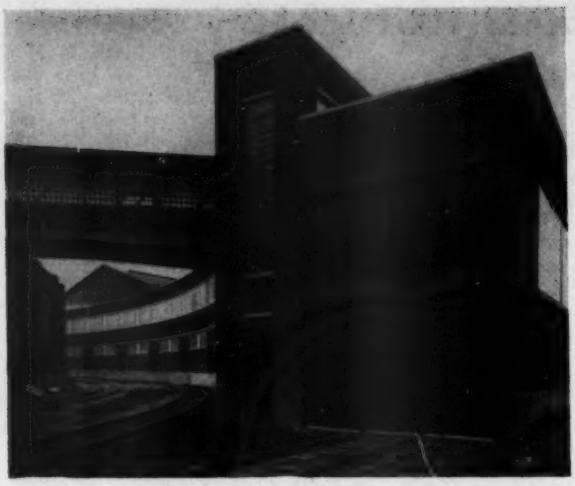
M. B. Skinner Co., South Bend, Ind. Entitled "Pipe Repair Handbook," a 12-page booklet illustrates and describes various types of pipe-line repair clamps manufactured by the company, together with uses and methods of application.

TOLEDO ENGINEERING CO. OPENS BALTIMORE OFFICE

The Toledo Engineering Co., Toledo, Ohio, has recently established a branch office at 220 East Lexington St., Baltimore, Md., in order to keep in closer touch with its Eastern clients and thereby render more efficient service. During the past two years the company has been handling an increasing amount of work in the East, including building construction, new melting equipment and reconstruction work for a number of glass plants. These activities have been under the direct supervision of C. W. Batchell, vice-president of the company, who has selected and maintained a crew of expert workmen.

Mr. Batchell will take direct charge of the new Baltimore office, where he will be available for consultation on plant problems and ready to submit estimates on new designs and reconstruction work for glass plants in the East. A registered professional engineer, Mr. Batchell has been actively engaged for the last 20 years in the design and construction of producer gas plants and continuous glass-melting furnaces for bottles, plate glass and window glass, as well as day tanks, pot furnaces and lehrs.

C. W. Batchell



A build-up of parallel bands of concrete, brick, stone and glass block with sash in alternating panels sweeps around the curved track side of the Lincoln Electric Co's new 200,000 sq. ft. all-welded factory and warehouse addition at Cleveland. The building which was designed by the Austin Co. utilizes a rigid trussless sawtooth design. The bridge in the foreground connects the addition to the company's existing plant. A continuous band of glass block extends the full length of the loading dock.

DECEMBER WINDOW GLASS PRODUCTION

Window glass production during December, 1937, was 953,964 boxes which represents 58.7 per cent of the industry capacity. The total production for 1937 amounted to 13,579,213 boxes which is 69.8 per cent of industry capacity.

PLATE GLASS PRODUCTION IN DECEMBER

The total production of polished plate glass for member companies of the Plate Glass Manufacturers of America for the month of December, 1937, was 8,920,809 sq. ft. as compared to 12,517,311 sq. ft. produced in the preceding month, November. This makes a total of 192,592,600 sq. ft., produced by these companies during 1937, as compared to 198,068,838 sq. ft. produced in 1936.

U S. GLASS CONCENTRATES OPERATIONS

Following the disposal of its Gas City, Ind., plant to the Slick Glass Co., the United States Glass Co. has continued a program of improvement and expansion at its plants in Tiffin, Ohio, and Glassport, Pa. The productive activities of the company will be concentrated in these two plants and it is expected that the completion of the plant improvement plans will result in a considerably increased capacity. The general administrative and executive offices of the company will remain at South Ninth and Bingham Sts., Pittsburgh, according to a recent statement by President D. M. Allgood.

PAPER ON CERAMIC EDUCATION

A paper entitled "Ceramic Enginering Education" will be presented before the Mineral Industry Education Division of the American Institute of Mining and Metallurgical Engineers by A. F. Greaves-Walker, head of the Ceramic Enginering Dept., University of North Carolina, during the annual meeting of the society this month.

GLASS AND POTTERY EXHIBITED

The 58th Annual Exhibit of the Associated Glass and Pottery Manufacturers was held at the Hotel William Penn, Pittsburgh, January 10-18. As in former years, this show provided a concentrated view of the latest developments in pressed, blown, decorated and cut glassware, as well as all kinds of dinner and kitchen ware, pottery products and glass and pottery novelties. Out of a total of over a hundred glass and pottery firms represented, about twenty American glass manufacturers exhibited products of outstanding beauty and utility.

Among the tableware manufacturers the exhibits of the Cambridge Glass Co. and the United States Glass Co. were especially noteworthy: the former showed a new line of stemware, beverage sets, etc., known as Gyro-Optic, in crystal and colors and a "Varitone" bridge set in pastel colors, as well as many new novelties, in addition to its regular line. U. S. Glass showed a completely new line of "Tiffin" ware, an outstanding feature of which is "Tiffin Guild" glass, consisting of off-hand items autographed by the glassmaker, Heinrich. Other featured designs are the "Spectra" and the "Black and Silver", all of which are the work of Prof. Kostellow, internationally famous artist.

Other glass manufacturers whose products received much attention were Bryce Bros. Co.; Consolidated Lamp & Glass Co., with a beautiline of "Martele" and "Catalonian"; Corning Glass Works, baking and cooking ware, decorated tumblers and tableware; Central Glass Works, featuring some particularly attractive stemware in lead glass with square, fluted and spiral stems; Dunbar Glass Corp., beverage sets and some beautiful novelties and stemware; Duncan & Miller Glass Co., whose new early-American "Sandwich" pattern with molded decoration in crystal received much favorable comment.

Fenton Art Glass Co. scored on its "Velvetone" line with landscape decoration and the "Sung Ko" vases and bowls; Imperial Glass Corp., with a varied line of tableware and special patterns in lead and lime glass; Indiana Glass Co., hand and machine made crystal and decorated ware; McKee Glass Co., featuring a new line of decorated kitchenware in white opal glass, decorated cooking ware and percolators; Jeannette Glass Co., kitchen and table ware in color; and New Martinsville Glass Mfg. Co., exhibiting a nice line of plain, etched and cut ware, in crystal and colors.

The exhibit of the Paden City Glass Mfg. Co. contained some notable plate-etched ware and new novelties in color; L. E. Smith Glass Co. showed some interesting console and table-decoration sets; Westmoreland Glass Co. featured its "Della Robbia" and a fine new line of decorated crystal. Pittsburgh Plate Glass Co. scored with its Carrara glass table pieces and furniture.

• A $250,000 international design contest, which may revolutionize interior decoration in American homes, is being planned by the 1939 Golden Gate International Exposition on San Francisco Bay. As far as glass is concerned, the field has been divided into two groups, the structural glass and the applied arts field.

• Word has been received of the resignation of Frank Lloyd, assistant to Charles E. McManus, president of the Crown Cork & Seal Co. Mr. Lloyd was formerly connected with Crown's glass production.

GORTON DUPLICATORS

Is the Mould Shop a Bottle Neck?

The mould shop may easily become the bottle neck in your plant — seriously affecting production schedules through lack of moulds to work with.

Gorton Duplicators accurately and speedily duplicate glass moulds of the most intricate design in any shape.

Gorton Duplicators are speeding up mould production in glass plants throughout the country. Send for Booklet 1319-B, showing numerous examples of time saving on plastic, rubber, glass moulds, etc.

GEORGE GORTON MACHINE CO
1102 13TH ST. RACINE WIS

CALCIMAG
PATENT PENDING
A CLINKERED DOLOMITE FOR THE GLASS BATCH...

Calcimag is granular... stands up in storage. It is uniform... reduces segregation. It is easy to handle... your men will like it. It melts more easily... lowers production costs.

GLASS BATCH

BASIC DOLOMITE INCORPORATED
HANNA BUILDING
CLEVELAND, OHIO

For Greater Economies in Glass Making!

SOLVAY
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Dustless Calcined
98 — 100%
POTASSIUM CARBONATE
Also Granular Hydrated (83-85%)

Combines *all* the chemical and physical properties essential to the finest glass manufacturing results . . . Density and granulation eliminate all danger of segregation of the batch . . . Absence of water of crystallization assures savings in transportation costs and in heat otherwise required to drive off this water in furnace or pot . . . A new SOLVAY domestic product already setting the standard in the Glass Industry.

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SOLVAY *Dustless Dense* SODA ASH

Research and improvements make this the outstanding Soda Ash for all quality glass-making purposes . . . More than 99.50% Sodium Carbonate on a dry basis . . . Maximum purity . . . Homogeneous mix guaranteed . . . Easy to store and handle . . . Economical . . . Grades suited for use with any of the known brands of commercial glass sands.

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Specialists in Colors, Metallic Oxides and Chemicals for the GLASS INDUSTRY

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Better Moulds
Better Glassware

- MIN-OX has been scientifically developed *for the glass industry exclusively.* A beautiful brilliancy and smooth detailed finish is imparted to the glass with Min-ox moulds.
- Reduction in cleaning costs is another important advantage. Fewer cleanings save time and money. MIN-OX moulds have a longer life . . . and fire-finishing is practically eliminated.
- Write today for details on why Min-ox moulds produce the finest glassware at minimum cost.

A trial will convince you.

THE BINNEY CASTINGS COMPANY
TOLEDO, OHIO
originators of alloys for glass molds

BINNEY

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Manufacturers Since 1836
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SUCCESS in marketing your product or service in the glass manufacturing field depends largely upon complete coverage of the industry.

PERSONAL contact is always the most effective method of selling but physical limitations make thorough penetration impossible . . . planned advertising, however, in THE GLASS INDUSTRY does accomplish this.

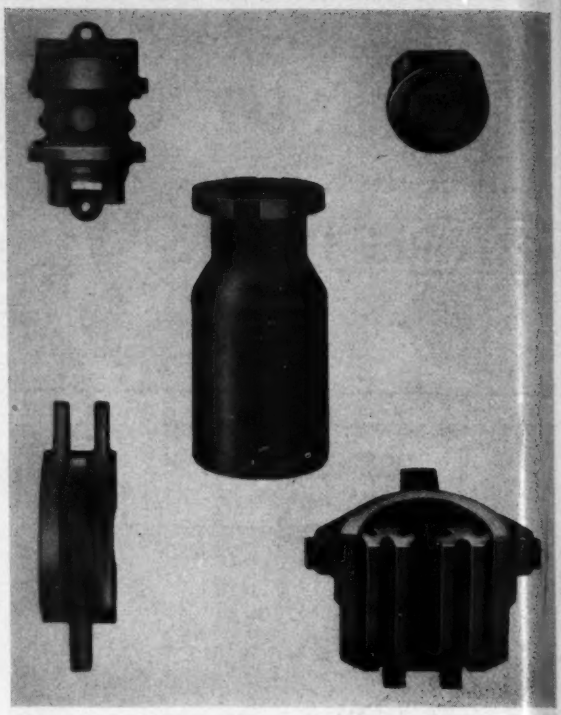
EDITED exclusively for glass plant executives THE GLASS INDUSTRY offers complete penetration of the field. It goes down byways as well as highways and carries a message to all companies and their executives, who either buy or influence buying of equipment, supplies, raw materials or service.

IT WILL supplement and support your personal selling . . . it will develop new outlets for you.

May we send you detailed facts?

The Glass Industry

11 W. 42nd St. New York City



Bottle Moulds of Gunite

PROPER analysis, method of melting and foundry practice of highest efficiency are responsible for **Gunite's** superiority for glasshouse castings.

Gunite is of just the right hardness for glass mould use. This quality facilitates easy machining and offers a density at all points assuring a metal which will take a brilliant polish. Chipping at exposed corners is reduced to a minimum in the machining operation.

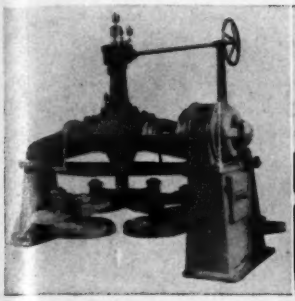
Excellent thermo-conductivity, resistance to heat fatigue, freedom from foundry defects and long life are a few of the plus values of **Gunite**. Our booklet will give you all the facts and a description of the complete line of Gunite glasshouse castings. May we send you a copy?

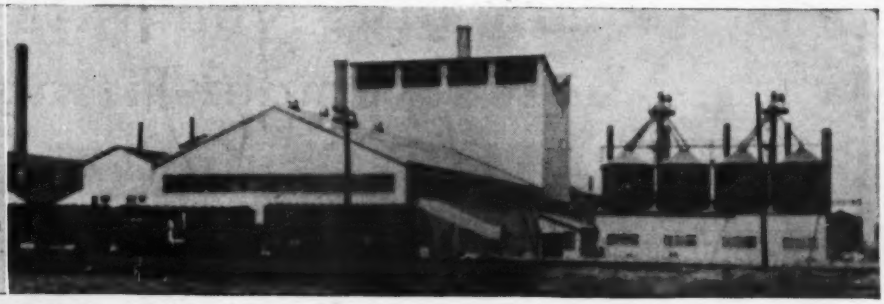
GUNITE FOUNDRIES CORPORATION

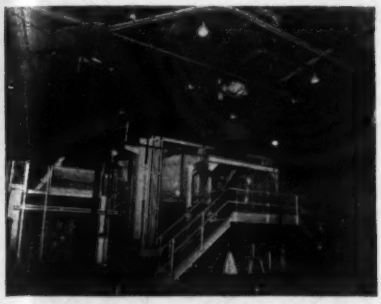
ROCKFORD ILLINOIS

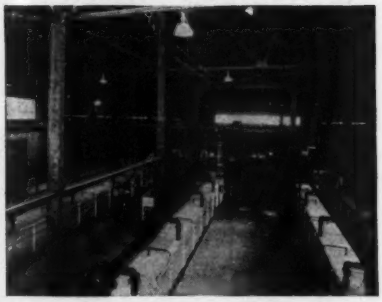
Established 1854

AMCO Equipment for Glass Plants









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Complete Glass Plants

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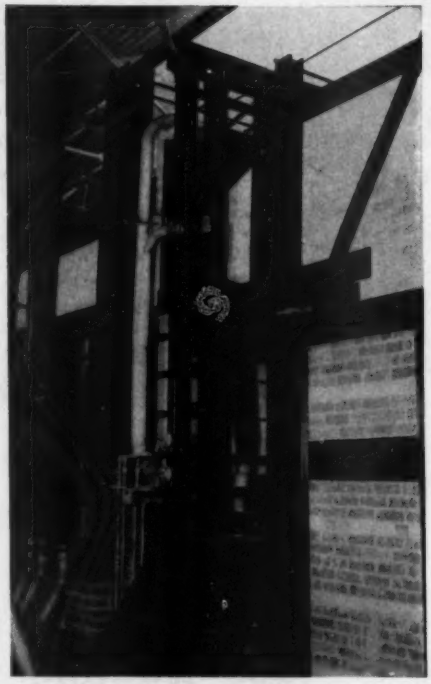
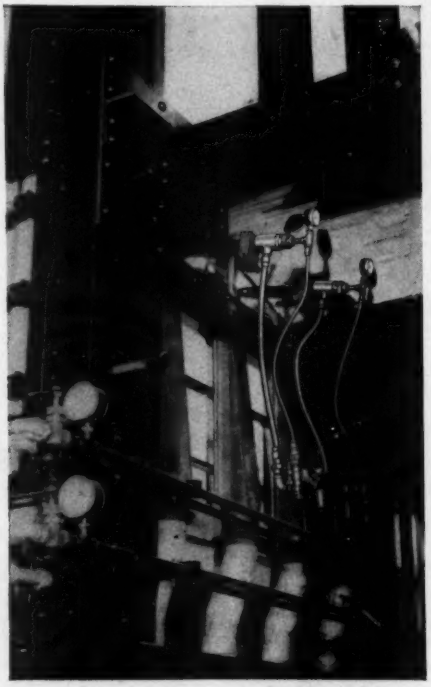


A recent end port furnace designed and built by TECO for the Swindell Bros. Inc., glass plant located at Baltimore, Md.

Two oil burners are located under each port. The arched port floor eliminates supporting steel. Burners are mounted with plenty of clearance to permit adjustment and removal. The burner blocks are supported directly above, but independent of the flux. Fuel is introduced directly to the furnace without impinging on the furnace or port refractories.



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Specializing in the design and construction of glass melting furnaces and auxiliary equipment.

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